

SUPPLEMENTAL DIRECT TESTIMONY OF
SHARI Y. ISHIKAWA

PRINCIPAL TRANSMISSION PLANNING ENGINEER
TRANSMISSION PLANNING DIVISION
POWER SUPPLY PLANNING AND ENGINEERING DEPARTMENT
HAWAIIAN ELECTRIC COMPANY, INC.

Subject: Changes to the Single Line Diagrams (“SLD”),
Corrections to the Direct Testimony, and March 3, 2004
Pukele Substation Outage

INTRODUCTION

Q. Please state your name and business address.

A. My name is Shari Y. Ishikawa and my business address is 820 Ward Avenue,
Honolulu, Hawaii.

Q. Have you previously submitted testimony in this proceeding?

A. Yes, I submitted written direct testimony and exhibits as HECO T-4.

Q. What did you address in HECO T-4?

A. In general, I addressed the need for (and alternatives considered to) the East Oahu
Transmission Project, which is intended to address several transmission problems
that affect system reliability, including:

- 1) The Koolau/Pukele Overload Situation;
- 2) The Downtown Overload Situation;
- 3) The Pukele Substation Reliability Concern; and
- 4) The Downtown Substation Reliability Concern.

Q. How does HECO plan to implement the project?

A. HECO proposes to implement the project in two independent phases, Phase 1 and
phase 2. Implementing the proposed project in two phases has been proposed to
address near-term transmission problems, such as the Koolau/Pukele Overload
Situation and a part of the Pukele Substation Reliability Concern, which includes
Waikiki, in a more timely manner.

Q. What is the purpose of your supplemental written direct testimony?

A. The purpose of my supplemental testimony is to update my direct testimony to
reflect two changes to Phase 1 of the proposed East Oahu Transmission Project
(the "EOTP"). The EOTP involves implementation of the Kamoku 46kV
Alternative – Expanded, which is described in HECO T-4 (pages 52-53, 59-63), in

1 two phases. Phase 1 is basically equivalent to the Kamoku 46kV Alternative,
2 which is also described in HECO T-4 (pages 50-52, 56-59). The reasons for the
3 two changes to Phase 1 of the EOTP are provided in the supplemental testimony
4 of Mr. Wong, HECO ST-2. My supplemental testimony:

- 5 1) provides changes to the single line diagrams (“SLD”) and revises my
6 exhibits showing the effectiveness (both as a result of the two changes
7 and as a result of corrections to the original exhibits) in addressing the
8 Pukele Reliability Concern,
- 9 2) provide corrections to a portion of my direct testimony, and
- 10 3) supplements my testimony on the need for the EOTP in light of the
11 March 3, 2004 Pukele Substation outage.

12
13 CHANGES TO THE SINGLE LINE DIAGRAMS (“SLD”)

14 Change #1

- 15 Q. Describe the equipment and connection changes for the Kamoku 46kV Alternative
16 – Expanded that have occurred as a result of the two Phase 1 changes.
- 17 A. The original project description is given on page 6 of the EOTP PUC application
18 filed on December 18, 2003 and is briefly described in HECO T-4 (page 49). In
19 Phase 1 of the Kamoku 46kV Alternative – Expanded, a new ductline
20 (approximately 3,450 feet in length) for two new 46kV circuits running from
21 Makaloa Substation to McCully Substation was to be installed, which would
22 connect the existing Archer 46 and Archer 41 46kV underground circuits with the
23 existing Pukele 2 46kV overhead circuit. Two changes to Phase 1 of the Kamoku
24 46kV Alternative – Expanded are being proposed. Change #1 would allow one of
25 the two new proposed 46kV circuits to be installed in the existing ductline from

1 Makaloa Substation to McCully Substation. The other new proposed 46kV circuit
2 would be installed in a new ductline from Makaloa Substation to Poni Street, then
3 transition into the existing ductline at Poni Street and continue in the existing
4 ductline all the way to McCully Substation. Refer to the supplemental testimony
5 of Mr. Wong in HECO ST-2 for a detailed description of the existing ducts and
6 circuits between Makaloa and McCully Substation and modifications required in
7 order to reuse the existing ducts. The following is a summary of the modifications
8 required in order to reuse the existing ducts:

- 9 1) installation of Makaloa #1 46-12kV transformer and switchgear at Makaloa
10 Substation (McCully #4 46-12kV transformer will be removed after Makaloa
11 #1 transformer is installed and 12 kV reconnections are made),
- 12 2) construction of a relatively short ductline (approximately 1,000 feet) from
13 manhole P2 fronting Makaloa Substation to manhole P4 at Poni Street,
- 14 3) implementation of various switching and reconnections on the 46 sub-
15 transmission and 12kV distribution system,
- 16 4) installation of 12kV cables to reroute the McCully Substation Kona Street
17 12kV circuit, and
- 18 5) removal of existing 46kV and 12kV cables running from Makaloa Substation
19 to McCully Substation and installation of new 46kV cables.

20 Change #2

21 Q. Describe the second change to Phase 1 of the Kamoku 46kV Alternative –
22 Expanded.

23 A. As described on page 7 of the EOTP PUC application, one new 46kV circuit in a
24 single ductline is proposed to connect the existing Archer 41 46kV overhead
25 circuit on Pumehana Street with the existing Pukele 2 46kV overhead circuit at the

1 intersection of Date and Pumehana Streets. The proposed change would extend
2 the underground connection from the existing Pukele 2 46kV overhead circuit at
3 the intersection of Date and Pumehana Streets to the Archer 46 46kV underground
4 circuit at the intersection of Lime and Pumehana Streets. Therefore, the existing
5 Archer 41 46kV overhead circuit on Pumehana Street would not be used as an
6 electrical pathway to connect the Pukele 2 and Archer 46 circuits. The proposed
7 revision includes installing approximately 720 feet of new ductline from manhole
8 P10 fronting McCully Substation on Lime Street to Pole 5 and the installation of
9 one 46kV cable in this new ductline. Refer to the supplemental testimony of Mr.
10 Wong, HECO ST-2 for a more detailed description of the proposed change.

11 SLD Changes and Revisions

12 Q. Will the proposed changes affect the SLD provided in your direct testimony,
13 HECO-417, HECO-419, HECO-423 and/or HECO-424?

14 A. Yes, changes to all four drawings are required and have been provided as HECO-
15 ST-401, HECO-ST-402, HECO-ST-403 and HECO-ST-404, respectively (i.e.
16 HECO-ST-401 replaces HECO-417, HECO-ST-402 replaces HECO-419, etc).
17 The changes are located in the lower right hand corner of each exhibit and are
18 shown as a dotted-dashed line from Makaloa Substation (Archer 46 46kV circuit)
19 to "Date Jct" and from Makaloa Substation (Archer 41 46kV circuit) to "Mcly
20 TP2" as shown on the exhibits.

21 Q. Were there other revisions made to the SLDs?

22 A. Other revisions to all four drawings were made that are not related to the two
23 proposed changes described earlier in my supplemental testimony. The SLD
24 revisions add more accuracy to the detail represented in HECO-417, HECO-419,
25 HECO-423 and HECO-424. The revisions do not electrically alter the project and

1 are corrections to what was originally filed in the direct testimony submittal. For
2 example, if HECO-419 and HECO-ST-402 are compared, the differences include
3 the addition of switches at the beginning of the Pukele feeders, which already
4 exist, and changes to how the connections between Pukele 5, Pukele 6, Archer 47
5 and Archer 48 are made. Another example is a second box labeled “Load
6 transferred” in HECO-ST-404. The text was added to provide more detail to
7 explain that, during a situation where both 138kV transmission lines to Pukele
8 Substation were lost, the loads on the Pukele 8 circuit would automatically be
9 transferred to other substations using the 12kV system. (The 12kV system is not
10 shown on HECO-ST-404 because this SLD represents only 46kV connections.)

11 Q. Please explain the SLD shown in HECO-ST-405.

12 A. For each phase, there should be a SLD for the Normal Load (condition with all
13 lines in), a Pukele Outage Condition (with Pukele Substation out of service) and a
14 Downtown Contingency Condition (which occurs when maintenance is being
15 performed on one of the three 138kV transmission lines feeding the downtown
16 area substations). HECO-417 and HECO-423 provided SLD for the Normal Load
17 of Phase 1 and Phase 2 Kamoku 46kV Alternative – Expanded project. HECO-
18 424 provided a SLD for the Pukele Outage Condition for Phase 2. An exhibit
19 representing the Pukele Outage Condition for Phase 1 was not provided in my
20 direct testimony, although it was explained in HECO T-4, (pages 56-57). HECO-
21 419 provided a SLD for the Downtown Contingency Condition for both Phase 1
22 and Phase 2, because the connections and switching will be the same for both
23 phases. The SLD in HECO-ST-405 shows Phase 1 of the Kamoku 46kV
24 Alternative – Expanded for the Pukele Outage Condition. The operation of Phase
25 1 was described in HECO T-4 (pages 56-57), and indicates the manual switching

1 required (which may take 2 to 4 hours to complete) in order to restore service to
2 the remaining customers on the Pukele 1 and Pukele 5 circuits. In Phase 1, these
3 customers will not be served through automatic transfers on the distribution
4 system or by the Kamoku or Archer 46kV connections provided with the
5 installation of Phase 1. HECO-419 and HECO-424 of my direct testimony
6 showed this manual switch connection carrying over to Phase 2 of the project,
7 which was an error. Phase 2 of the project does not require this manual switching,
8 because the remaining Pukele customers will be automatically transferred to
9 Archer circuits, as is described in HECO T-4 (page 60). Therefore, HECO-ST-
10 402 and HECO-ST-404, which replace HECO-419 and HECO-424, respectively,
11 do not show a manual switching connection between the Pukele 5 circuit and the
12 Koolau Substation through the use of the Koolau-Nuuanu-Laeae 46kV circuit.

13 Effectiveness of the Kamoku 46kV Alternative – Expanded With the Proposed Changes

14 Q. Will the proposed changes to Phase 1 described earlier affect the operation of the
15 transmission and sub-transmission system in the area?

16 A. Yes. HECO T-4 (pages 56-60) describes how Phase 1 and Phase 2 of the Kamoku
17 46kV Alternative – Expanded will allow 80 MW of existing load, which is served
18 from the Pukele Substation, to be shifted from the Northern Corridor to the
19 Southern Corridor and be served by Archer and Kamoku Substations. With the
20 proposed changes, approximately 90 MW of existing load can be shifted from
21 Pukele Substation to Archer and Kamoku Substations.

22 Q. Please describe the effectiveness of Phase 1 and Phase 2 of the Kamoku 46kV
23 Alternative - Expanded with the proposed changes, which you just described.

24 A. There would be no change in the effectiveness of either Phase 1 or Phase 2 in
25 resolving the Koolau/Pukele Overload Situation and the Downtown Substation

1 Reliability Concern. With the proposed changes, however, the project would
2 more effectively address the Pukele Substation Reliability Concern for Phase 1
3 and Phase 2, because customers served from the McCully #4 transformer and
4 associated distribution circuits would now be served from the Makaloa #1
5 transformer and associated distribution circuits. As shown on HECO-420,
6 portions of the McCully Substation would experience a 6-second outage if the
7 original Kamoku 46kV Alternative – Expanded were installed and both 138 kV
8 transmission lines to Pukele Substation were suddenly not available. With the
9 proposed changes, none of the McCully Substation customers would experience
10 even a 6-second interruption of electricity service if the 138kV feeds to Pukele
11 Substation were suddenly not available. Changes to the tables in HECO-420 and
12 HECO-425 are attached as exhibits HECO-ST-406 and HECO-ST-407
13 respectively.

14 Q. Would the proposed changes impact the effectiveness to resolve the Downtown
15 Overload Situation?

16 A. Yes. Installing the Makaloa #1 transformer and removing the McCully #4
17 transformer will accelerate the Downtown Line Overload Situation in both Phase
18 1 and Phase 2 of the Kamoku 46kV Alternative – Expanded project because
19 additional load from the Makaloa #1 transformer will be served from the Archer
20 Substation. Prior to the proposed change approximately 80 MW of load was
21 being transferred from Pukele Substation to Archer and Kamoku Substations,
22 because the McCully #4 transformer was being served from the Pukele Substation
23 with the installation of Phase 1 of the Kamoku 46kV Alternative – Expanded.
24 With the proposed changes, the load being served by Archer and Kamoku
25 Substations will increase by approximately 10 MW for a total of 90 MW. As is

1 explained below, only 70MW would be shifted back to Pukele Substation during a
2 Downtown Contingency condition. It may be possible, however, to shift the
3 entire 90 MW of load between Pukele Substation and Archer and Kamoku
4 Substation with additional modification to the Kamoku 46kV Alternative –
5 Expanded and this is being reviewed.

6 Q. Are there any revisions to HECO-420 and HECO-425 that are not a result of the
7 proposed changes to Phase 1?

8 A. Yes, HECO-420 and HECO-425 incorrectly indicated that a portion of the
9 customers served from the Kuhio Substation would experience a 6-second outage
10 if both 138kV feeds to Pukele Substation were suddenly not available. This
11 should be corrected to show that none of the customers served from the Kuhio
12 Substation would experience even a 6-second interruption of service. HECO-ST-
13 402 and HECO-ST-403 reflect this revision.

14
15 CORRECTION TO DIRECT TESTIMONY

16 Q. Please explain the correction to your direct testimony.

17 A. HECO T-4 (page 58) explains how the 46kV system would be operated with the
18 installation of the Kamoku 46kV Underground Alternative – Expanded during a
19 Downtown Contingency Condition. The testimony incorrectly indicated that the
20 entire 80 MW that will be shifted from the Pukele Substation to the Archer and
21 Kamoku Substations could be shifted back to the Pukele Substation during a
22 Downtown Contingency Condition. The testimony should be corrected to reflect
23 that approximately 70 MW would be shifted back from Archer and Kamoku
24 Substations to Pukele Substation. For the original Kamoku 46kV Underground
25 Alternative – Expanded (prior to Change #1 and Change #2 described earlier in

1 my testimony), approximately 10 MW of load (which is being served by the
2 Pukele Substation prior to the installation of the Kamoku 46kV Underground
3 Alternative – Expanded) that will be shifted to the Archer as a result of the
4 project, will not be able to shift back to the Pukele Substation. With the proposed
5 changes to Phase 1 of the Kamoku 46kV Underground Alternative – Expanded
6 (Change #1 and Change # 2 described earlier in my supplemental testimony),
7 approximately 90 MW of load will be shifted from Pukele Substation to the
8 Downtown area substations and only 70 MW will be able to shift back to Pukele
9 Substation during the Downtown Contingency Condition. This is shown in the
10 lower right hand corner of HECO-ST-403. The load being transferred to Archer
11 41 from the Pukele 2 46kV circuit will not be transferable back to Pukele
12 Substation. It may be possible, however, to shift the entire 90 MW of load
13 between Pukele Substation and Archer and Kamoku Substation with additional
14 modification to the Kamoku 46kV Alternative – Expanded and this is being
15 reviewed.

16 Q. Does this affect the effectiveness of the Kamoku 46kV Underground Alternative –
17 Expanded project?

18 A. Prior to Change #1 and Change #2 described earlier in my supplemental
19 testimony, the deferral of the Downtown Overload Situation with the continued
20 operation of the Honolulu Power Plant (“HPP”) remains about the same. If HPP
21 is not in operation, however, the deferral of the Downtown Overload Situation is
22 reduced.

23 Q. Please explain the deferral of the Downtown Overload Situation with HPP in
24 operation.

25 A. The shifting of load between Pukele Substation and Archer and Kamoku

Substations is explained above. With the installation of the original Kamoku 46kV Underground Alternative – Expanded, approximately 70 MW of the 80 MW shifted from Pukele Substation to Archer and Kamoku Substations could be shifted back to the Pukele Substation during a Downtown Contingency Condition. HECO T-4 (page 58) also notes that additional load from the Piikoi Substation could be transferred to the Pukele Substation to further reduce the loading on the Downtown area substations. The amount of load that can be shifted from Piikoi to Pukele takes into account the assumption that the Piikoi Substation will grow every year based on the August 2002 Load Forecast, which was explained in HECO T-4 (page 2 16-20). With HPP not retired, the original Kamoku 46kV Underground Alternative – Expanded installed, and the Piikoi load (at an assumed growth rate based on the August 2002 Load Forecast) shifted to Pukele Substation, the Downtown Line Overload Situation can still be deferred by approximately three years from 2023 to 2026. This is the three-year deferral identified in my direct testimony, in HECO T-4 (page 58). With the proposed changes to the Kamoku 46kV Underground Alternative – Expanded (Change #1 and Change #2 to Phase 1 of the project described earlier in my supplemental testimony), the deferral of the Downtown Line Overload Situation could remain the same or decrease, although this is still being reviewed.

Q. Please explain the situation with HPP not in operation.

A. As explained in HECO T-4 (pages 60-61), this project would not solve the Downtown Overload Situation if HPP is not in operation although it was estimated that the overload situation would be deferred from 2006 to 2009. This three-year deferral estimate is incorrect and the Downtown Overload Situation could be deferred by approximately one year.

1 Q. Please explain why there is only approximately one year of deferment without
2 HPP.

3 A. The deferral of the Downtown Overload Situation with the installation of the
4 Kamoku 46kV Alternative – Expanded is dependent on two factors which are 1)
5 the shifting of load between Pukele Substation and Archer and Kamoku
6 Substations and 2) the shifting of the Piikoi Substation load from Archer
7 Substation to the Pukele Substation. With the original Kamoku 46kV
8 Underground Alternative – Expanded the load shifted back to Pukele Substation
9 from Archer and Kamoku Substations would be 70 MW, not 80 MW. (Also, the
10 load shifted from Piikoi to Pukele during the earlier years will not be as high as
11 what was assumed in 2023.) Without the operation of HPP and the installation of
12 the original Kamoku 46kV Underground 46kV Alternative – Expanded, the
13 Downtown Line Overload will occur in 2006. Therefore, even when the Piikoi
14 load is shifted to the Pukele Substation during a Downtown Contingency
15 Condition, the Downtown Line Overload will only be deferred by approximately
16 on year. With the proposed changes to the Kamoku 46kV Underground
17 Alternative – Expanded (Change #1 and Change #2 to Phase 1 of the project
18 described earlier in my supplemental testimony), the deferral of the Downtown
19 Line Overload Situation could be approximately the same (one year) or decrease
20 although this is still being reviewed.

21
22 THE MARCH 3, 2004 PUKELE SUBSTATION OUTAGE

23 Q. Please describe the March 3, 2004 disturbance on the HECO system.

24 A. On March 3, 2004, approximately 40,000 of HECO's customers in the
25 Honolulu/East Oahu area, including Waikiki, lost power. The Pukele Substation

1 serves the affected areas. One of the two transmission lines serving the Pukele
2 Substation was out for scheduled maintenance when the second transmission line
3 went out of service and resulted in the power outage. The sustained outage would
4 have been prevented if the East Oahu Transmission Project had been completed.
5 Many of the customers affected on March 3, 2004 would not have seen any
6 interruption in service, while the other affected customers would have experienced
7 a momentary interruption of service lasting only seconds.

8 Q. Have there been previous incidents where both 138kV Koolau/Pukele
9 transmission lines were unavailable?

10 A. As stated in HECO T-4 (page 35), prior to March 3, 2004, HECO had been
11 fortunate that the second of the two 138kV lines to Pukele Substation had not
12 tripped out of service while the other line was out for maintenance or out of
13 service due to a forced outage. HECO T-4 (page 65) also emphasized the need to
14 address the Koolau/Pukele Overload Situation and Pukele Substation Reliability
15 Concern. The March 3, 2004 Pukele outage incident has accentuated the need to
16 proceed with the project.

17 Q. Does this conclude your supplemental testimony?

18 A. Yes, it does.

19

20

21

22

23

24

25